St. Anthony Falls Laboratory

Department of Civil Engineering

College of Science & Engineering

University of Minnesota

Effective Impervious Area in Urban Stormwater Management

Ali Ebrahimian[1], John Gulliver[2], and Bruce Wilson[3]

[1,2] St. Anthony Falls Laboratory, Department of Civil Engineering, University of Minnesota, 2 Third Ave SE, Minneaplis, MN 55414

[3] Department of Bioproducts and Biosystems Engineering, University of Minnesota, St. Paul, MN 55108

Definition of Effective Impervious Area (EIA)

- portion of total impervious area that is directly (hydraulically) connected to the storm sewer system

Importance of EIA

- Using EIA in urban hydrologic modeling prevents overestimation of runoff volumes and rates.

- EIA is the primary contributing area for smaller storms and the main concern for water quality.

Implications of EIA in Sustainable Development

- More effective planning, locating and design of stormwater control measures (SCMs)
- Identifying stormwater runoff pollution sources and environmental pollution control
- Cost saving
- Public consent due to decrease in project costs

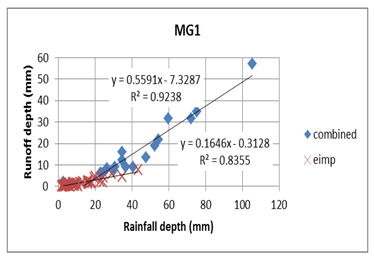
Objective:
Develop Methods to Accurately Estimate EIA in Urban Watersheds

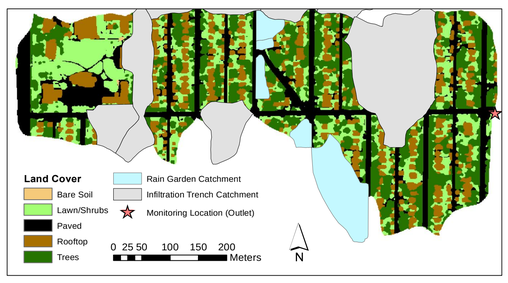
Current methods for Determination of EIA

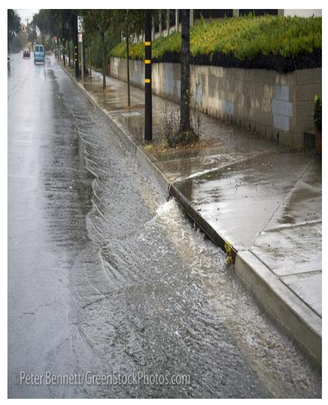
1) Rainfall-Runoff analyses

2) GIS based methods

3) Field investigations







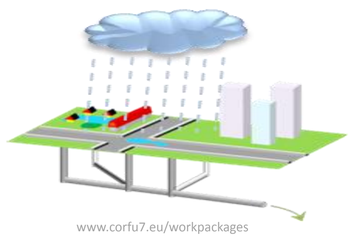
SUSTAINABILITY STORY

- Developing a sustainable urban stormwater infrastructure needs an improved modeling of rainfall-runoff process.

- EIA is the most important parameter in determining the actual urban runoff. Knowledge of EIA will improve rainfall-runoff modeling.

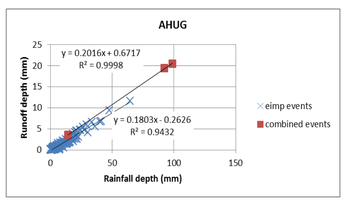
Interdisciplinary Study:

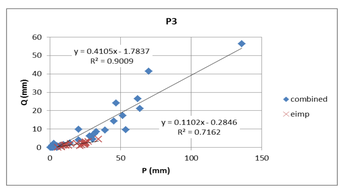
- Urban Hydrology
- Geographic Information Systems (GIS)
- Statistical Parameter Estimation



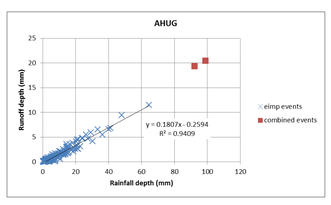
Improving the Existing Rainfall-Runoff method

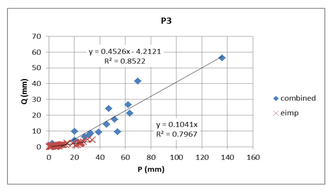
Original method





Improved method



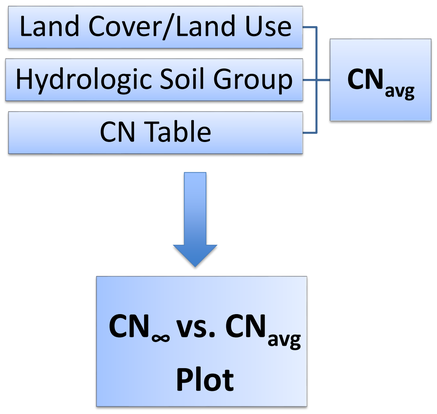


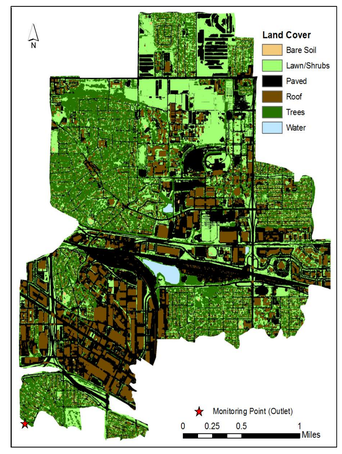
Application of the Improved Rainfall-Runoff Method to Urban Watersheds in Twin Cities Metro Area

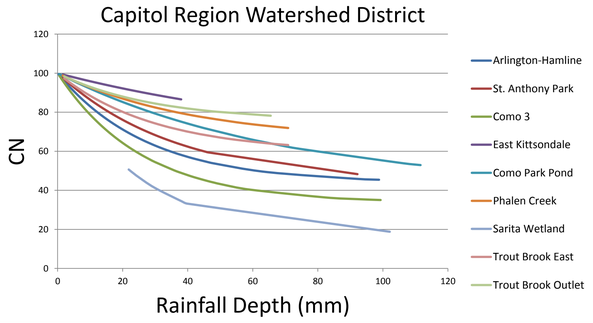
Row	Monitoring Site Name	Area (ha)	TIA (%)	EIA (%)
Capitol Region Watershed District, MN				
1	Arlington-Hamline Facility (AHUG)	20.2	44.0	18.1
2	Como Park Regional Pond inlet (GCP)	51.8	39.0	24.0
3	Como 3	185.8	33.0	12.2
4	Sarita (inlet)	376.0	16.0	7.1
5	Trout Brook- East Branch (TBEB)	377.2	34.3	19.8
6	East Kittsondale	451.6	46.0	39.1
7	Phalen Creek	579.9	50.0	30.5
8	St. Anthony Park	1,383.2	55.0	16.5
9	Trout Brook Outlet (TBO)	2,034.8	40.0	26.5
Three Rivers Park District, MN				
1	Maple Grove 1 (MG1)	5.5	40.5	16.5
2	Maple Grove 2 (MG2)	3.5	38.8	24.5
3	Plymouth 1 (P1)	5.1	38.0	20.8
4	Plymouth 2 (P2)	6.8	35.1	11.4
5	Plymouth 3 (P3)	5.6	27.3	10.4

Development of a New Method Based on the Integration of GIS and Curve Number (CN)

- Investigates different CN behaviors in urban watersheds and evaluates CN at the basin scale from rainfall-runoff events
- Applicable to un-gauged watersheds







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1) Graduate Research Assistant , Email: ebrah034@umn.edu 2) Professor, Email: gulli003@umn.edu 3) Professor, Email: wilson@umn.edu

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